

1 CLAIMS

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3 1. A method comprising:

4 generating an edge map from scanned image data; and

5 analyzing the edge map to determine a plurality of boundaries; and

6 evaluating the boundaries based on a set of rules to identify a plurality of

7 objects.

8

9 2. A method as recited in claim 1, wherein the analyzing further

10 comprises taking a Hough transform of the scanned image to determine the

11 boundaries.

12

13 3. A method as recited in claim 1, wherein a first object of the objects is

14 aligned with respect to another object of the objects.

15

16 4. A method as recited in claim 1, wherein at least one subset of the

17 objects are rectangular in shape.

18

19 5. A method as recited in claim 1, wherein at least one subset of the

20 plurality of objects are photographs.

21

22 6. A computer readable medium comprising computer-executable

23 instructions to perform a method as recited in claim 1.

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1           7. A method for detecting one or more objects in image data, the  
2 method comprising:

3           generating an edge map from the image data; and

4           analyzing the edge map to determine a plurality of boundaries of the one or  
5 more objects.

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7           8. A method as recited in claim 7, wherein the one or more objects are  
8 photographs.

9  
10          9. A method as recited in claim 7, wherein the one or more objects are  
11 rectangular in shape.

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13          10. A method as recited in claim 7, further comprising segmenting the  
14 one or more objects based on the set of boundaries.

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16          11. A method as recited in claim 7, wherein the edge map comprises an  
17 array of elements, each element representing a respective pixel of the image data;  
18 and

19          wherein the generating further comprises:

20                 estimating a background color of a scanner lid;

21                 for each pixel of at least one subset of the image data:

22                         identifying an absolute difference between a value of a  
23 current pixel and the background color; and  
24  
25

1 if the absolute difference is greater than a predetermined  
2 threshold, indicating that a corresponding array element represents a pixel of the  
3 at least one subset of image data that belongs to an edge.

4  
5 **12.** A method as recited in claim 7:

6 wherein the edge map comprises an array of elements, each element  
7 representing a respective pixel of the image data;

8 wherein the analyzing further comprises:

9 transforming the array of elements to produce a set of domain peaks,  
10 each domain peak corresponding to a straight line of a set of straight lines; and

11 determining which of the straight lines belong to the  
12 set of boundaries based on a set of rules.

13  
14 **13.** A method as recited in claim 12, wherein the determining further  
15 comprises:

16 identifying a boundary set that indicates an object at a distinct angle  
17 as compared to an orientation of a previously found object;

18 identifying a boundary set that indicates an object having a same  
19 dimension as a previously found object; and

20 identifying pairs of parallel and perpendicular boundaries that  
21 indicate an object that satisfies a substantially non-background interior condition  
22 with a previously found object.

1           **14.**     A method as recited in claim 12:  
2           wherein the edge map comprises an array of elements, each element  
3           representing a respective pixel of the image data; and  
4           wherein the transforming further comprises taking a Hough transform of  
5           the array of elements to produce the set of domain peaks.

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7           **15.**     A method as recited in claim 7:  
8           wherein the edge map comprises an array of elements, each element  
9           representing a respective pixel of the image data;  
10          wherein the analyzing further comprises:  
11                  transforming the array elements to produce a set of domain peaks,  
12          each domain peak corresponding to a straight line of a set of straight lines; and  
13                  determining which of the straight lines belong to the set of  
14          boundaries based on a set of rules, the set of rules comprising rules that are  
15          directed to:  
16                  identifying a first object with a first dimension; and  
17                  seeking a same sized object with a second dimension that  
18          corresponds to the first dimension

19  
20          **16.**     A method as recited by claim 15, wherein the identifying comprises:  
21          determining a background color;  
22          determining a candidate object; and  
23          if an interior portion of the candidate object is not consistent with the  
24          background color, concluding that the candidate object is the first object.  
25

1           **17.**    A method as recited in claim 15, wherein a line of the straight lines  
2 corresponds to a candidate object, the seeking further comprising:

3                detecting a first image to background transition that corresponds to the first  
4 image, and a second image to background transition that corresponds to the line;  
5 and

6                if the first image to background transition does not coincide with the second  
7 image to background transition, assigning the line to be a boundary of a different  
8 object.

9  
10           **18.**    A computer readable medium comprising a computer program  
11 configured to perform a method as recited in claim 1.

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13           **19.**    A method for detecting whether image data represents more than  
14 one object, the method comprising:

15                determining a background color of a scanner lid;  
16                identifying a set of transitions between the background color and other  
17 colors that correspond to the image data; and  
18                analyzing the set of transitions to detect a set of image data characteristics;  
19                estimating based on a set of one or more rules, a number of objects based  
20 on the set of image data characteristics.

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22           **20.**    A method as recited in claim 19, wherein the objects are rectangular  
23 in shape.  
24  
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1           **21.**    A method as recited in claim 19, wherein the image data is scanned  
2 preview image data.

3  
4           **22.**    A method as recited in claim 19, wherein the analyzing further  
5 comprises taking a Hough transform of the set of transitions to detect the set of  
6 image data characteristics.

7  
8           **23.**    A method as recited in claim 19, further comprising:  
9           calculating a set of boundaries that delineate the objects based on the set of  
10 image data characteristics; and  
11           segmenting the objects from the image data based on the set of boundaries.

12  
13           **24.**    A method as recited in claim 19, wherein the identifying further  
14 comprises:

15           for each row(i) of image data:

16                   calculating a left(i) transition from background data to image data;

17                   calculating a right(i) transition from image data to background data;

18                   determining a difference(i) between right(i) transition and left(i)

19 transition;

20           for each column(j) of image data:

21                   calculating a top(j) transition from background data to image data;

22                   calculating a bottom(j) transition from image data to background

23 data;

24                   determine a difference(j) between bottom(j) transition and top(j)

25 transition;

1 generating a first histogram from each difference(i);  
2 generating a second histogram from each difference(j); and  
3 using a set of characteristics that are displayed by the first and second  
4 histograms display to determine whether the image data represents one objects or  
5 more than one object.

6  
7 **25.** A method as recited in claim 19, further comprising:

8 generating a first histogram representing horizontal transitions from the  
9 transitions;

10 generating a second histogram representing vertical transitions from the  
11 transitions;

12 the first and second histograms displaying a set of peaks that identify  
13 whether the image data comprises more than one object; and

14 the set of rules comprising the following rules:

15 (a) if the set of peaks comprises only a single peak, classifying the  
16 image data as containing only a single object;

17 (b) if the set of peaks comprises only two peaks, classifying the  
18 image data as containing multiple objects;

19 (c) classifying the image data as comprising multiple objects if there  
20 is a gap in either the first histogram or the second histogram; and

21 (d) if neither (a), (b), or (c) apply, classifying the image data as  
22 comprising multiple objects.

1           **26.** One or more computer-readable media containing a computer  
2 executable program that performs a method as recited in claim 19.

3  
4           **27.** A device for detecting multiple objects in image data, the device  
5 comprising:

6           a processor configured to execute computer program instructions for:

7                   generating an edge map from the image data;

8                   analyzing the edge map to determine a set of boundaries of the one  
9 or more objects; and

10                  segmenting the one or more objects based on the set of boundaries.

11  
12           **28.** A device as recited in claim 27, wherein the analyzing further  
13 comprises taking a Hough transform of the edge map to determine the set of  
14 boundaries.

15  
16           **29.** A device as recited in claim 27, wherein the analyzing further  
17 comprises:

18           determining a set of transitions between the set of boundaries and a  
19 background color;

20           identifying a set of characteristics from the set of transitions, the set of  
21 characteristics being used to indicate whether the image data comprises a single  
22 object or whether the image data comprises a plurality of objects; and

23           if the image data corresponds to a plurality of objects, assigning particular  
24 ones of the set of boundaries to particular ones of the plurality of objects based  
25 on a set of rules.



1  
2       **30.**    A device as recited in claim 29, wherein the set of rules comprises  
3 rules that are directed to:

4               determining a background color of a scanner lid;

5               determining a candidate object;

6               determining that the candidate object is a first object, the first object  
7 having a first dimension if an interior portion of the candidate object is not  
8 consistent with the background color; and

9               seeking a same sized object with a second dimension that  
10 corresponds to the first dimension.  
11

12       **31.**    A device as recited in claim 29, wherein the set of rules comprises  
13 rules that are directed to:

14               determining a background color of a scanner lid;

15               determining a first candidate object;

16               if an interior portion of the first candidate object is not consistent  
17 with the background color, determining that the first candidate object is a first  
18 object, the first object having a first dimension; and

19               seeking a same sized object with a second dimension that  
20 corresponds to the first dimension, the seeking comprising:

21               identifying a boundary of the set of boundaries that  
22 corresponds to a second candidate object;

23               detecting a first image to background transition that  
24 corresponds to the first object, and a second image to background transition that  
25 corresponds to the boundary; and

1 if the first image to background transition does not coincide with the second  
2 image to background transition, assigning the boundary to the same sized object.

3  
4 **32.** A device as recited in claim 29, wherein the identifying further  
5 comprises:

6 for each row(i) of image data:

7 calculating a left(i) transition from background data to image data;

8 calculating a right(i) transition from image data to background data;

9 determine a difference(i) between right(i) transition and left(i)  
10 transition;

11 for each column(j) of image data:

12 calculating a top(j) transition from background data to image data;

13 calculating a bottom(j) transition from image data to background  
14 data;

15 determine a difference(j) between bottom(j) transition and top(i)  
16 transition;

17 generating a first histogram from each difference(i);

18 generating a second histogram from each difference(j); and

19 wherein the first and second histograms display the set of characteristics.  
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1           **33.**     A device as recited in claim 29, wherein the set of rules is a first set  
2 of rules, and wherein the set of characteristics indicate a set of peaks that are used  
3 to identify whether the image data comprises a single object or a plurality of  
4 objects based on a second set of rules, the second set of rules comprising rules that  
5 are directed to:

6                   (a) if the set of peaks comprises only a single peak, classifying the  
7 image data as containing only a single object;

8                   (b) if the set of peaks comprises only two peaks, classifying the  
9 image data as containing a plurality of objects;

10                  (c) if there is a gap in either the first histogram or the second  
11 histogram, then classifying the image data as comprising containing a  
12 plurality of objects; and

13                  (d) if neither (a), (b), or (c) apply, classifying the image data as  
14 comprising containing a plurality of objects.

15  
16           **34.**     A computer readable storage medium comprising a program module  
17 for detecting multiple objects in image data, wherein the program module  
18 performs acts comprising:

19                   generating an edge map from the image data; and

20                   analyzing the edge map to determine a set of boundaries of the one or more  
21 objects.

22  
23           **35.**     A computer readable storage medium as recited in claim 34,  
24 wherein the one or more objects are photographs.  
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1        36. A computer readable storage medium as recited in claim 34,  
2 wherein the one or more objects are rectangular in shape.

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4        37. A computer readable storage medium as recited in claim 34,  
5 wherein the program module further performs acts comprising segmenting the one  
6 or more objects based on the set of boundaries.

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8        38. A computer readable storage medium as recited in claim 34,  
9 wherein the edge map comprises an array of elements, each element representing a  
10 respective pixel of the image data; and

11        wherein the generating further comprises:

12                estimating a background color of a scanner lid;

13                for each pixel of the image data:

14                        identifying an absolute difference between a value of the  
15 pixel and the background color; and

16                        if the absolute difference is greater than a predetermined  
17 threshold, indicating that a corresponding array element represents a pixel of the  
18 image data that belongs to an edge.

19  
20        39. A computer readable storage medium as recited in claim 34,  
21 wherein the analyzing further comprises:

22                transforming the array elements to produce a set of domain peaks, each  
23 domain peak corresponding to a straight line of a set of straight lines; and

24                determining which of the straight lines belong to the set of boundaries  
25 based on a set of rules.

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2       **40.**   A computer readable storage medium as recited in claim 39,  
3 wherein the transforming further comprises taking a Hough transform of the array  
4 of elements to produce the set of domain peaks.

5  
6       **41.**   A computer readable storage medium as recited in claim 34,  
7 wherein the analyzing further comprises:

8           transforming the array elements to produce a set of domain peaks, each  
9 domain peak corresponding to a straight line of a set of straight lines; and

10          determining which of the straight lines belong to the set of boundaries  
11 based on a set of rules, the set of rules comprising rules that are directed to:

12               identifying a first object with a first dimension; and

13               seeking a same sized object with a second dimension that  
14 corresponds to the first dimension.

15  
16       **42.**   A computer readable storage medium as recited in claim 41,  
17 wherein the identifying comprises:

18           determining a background color of a scanner lid;

19           determining a candidate object; and

20           if an interior portion of the candidate object is not consistent with the  
21 background color, concluding that the candidate object is the first object.

1       **43.**   A computer readable storage medium as recited in claim 41,  
2 wherein a line of the straight lines corresponds to a candidate object, the seeking  
3 further comprising:

4       detecting a first image to background transition that corresponds to the first  
5 image, and a second image to background transition that corresponds to the line;  
6 and

7       if the first image to background transition does not coincide with the second  
8 image to background transition, assigning the line to be a boundary of a different  
9 object.

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11       **44.**   A computer comprising one or more computer-readable media as  
12 recited in claim 34.  
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